

Household Plastic Waste Management Strategies for Socio-economic and Environmental Sustainability in Eldoret City, Kenya

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Abstract: *Household plastic waste management has emerged as a critical challenge in rapidly urbanizing areas across the globe, including Eldoret City, Kenya. The proliferation of single-use plastics and inadequate waste disposal systems exacerbate environmental degradation and strain local economies. This study explores sustainable strategies for managing household plastic waste to promote socio-economic and environmental sustainability in Eldoret City. Using a desktop research approach, the study examines Eldoret waste management practices, circular economy, stakeholder involvement, and strategies for socio-economic and environmental sustainability. Key findings indicate that the absence of an efficient waste segregation and recycling system, coupled with limited public awareness, contributes to the escalating plastic waste crisis in the city. Innovative strategies such as community-based waste collection, the establishment of plastic recycling centers, and the promotion of circular economy principles are highlighted as viable solutions. Additionally, public-private partnerships, policy reforms, and incentivized waste management programs are essential to enhance participation and accountability among stakeholders. The study emphasizes the socio-economic benefits of effective plastic waste management, including job creation, reduced environmental health risks, and enhanced urban livability. Recommendations include fostering public awareness campaigns, investing in recycling infrastructure, and integrating informal waste collectors into formal systems.*

Keywords: household plastic waste management, socio-economic sustainability, circular economy

INTRODUCTION

Household plastic waste management has emerged as a critical global challenge, particularly in urban centers where rapid population growth and industrialization have intensified waste generation (Roche Cerasi et al., 2021; Shershneva, 2021; Wang et al., 2021). Eldoret City, a vibrant agricultural and business transit urban hub in Kenya, is no exception to this trend. The accumulation of plastic waste poses significant environmental and health risks, including soil degradation, water pollution, and harm to wildlife (Yusuf et al., 2022). This problem has been exacerbated by ineffective waste management systems and a lack of public awareness (Debrah et al., 2021), hindering efforts to address the issue sustainably.

Plastic waste has become a global environmental challenge, with households contributing significantly to the growing volumes of improperly managed plastic materials (Shershneva, 2021). Many urban centers such as Eldoret City are experiencing rapid urbanization, population growth, and increased reliance on plastic products thereby escalated waste management challenges. Household-generated plastic waste, often characterized by single-use items such as bottles, bags, and packaging materials, poses serious threats to environmental health, public safety, and sustainable urban development (Borg et al., 2022).

Household plastic waste in Eldoret City, constitutes a considerable portion of municipal solid waste finding its way to local landfills or dumpsites if collected. When not collected, the waste spills to the rivers, land or at times consumed by animals. This menace, coupled with continued use of rudimentary waste management practices, necessitates creative, innovative and inclusive strategies to manage such wastes effectively (Shelemo, 2023). Proper waste management not only mitigates environmental hazards but also offers opportunities for socio-economic development.

The ineffective management of household plastic waste in Eldoret City contributes to environmental degradation, including pollution of land and water bodies, loss of biodiversity, and the clogging of urban drainage systems, leading to flooding (Nyawira, 2023; Omokaro et al., 2024). Beyond environmental implications, mismanagement of plastic waste also has socio-economic impacts, such as increased healthcare costs due to pollution-related diseases and missed opportunities for income generation through recycling, upcycling and waste recovery. Addressing these challenges requires a multi-faceted approach that integrates sustainable waste management practices with socio-economic strategies tailored to the local context.

This paper explores innovative solutions to manage household plastic waste in Eldoret City while fostering socio-economic and environmental sustainability. By examining the current state of plastic waste management practices, identifying gaps in existing systems, and proposing community-centered and policy-driven strategies, this study aims to highlight pathways for a

cleaner environment and a resilient local economy. Ultimately, the paper underscores the significance of promoting public awareness, enhancing waste segregation practices, and leveraging technology and entrepreneurship to transform plastic waste management from a challenge into an opportunity for sustainable development in Eldoret City.

Statement of the Problem

The proliferation of plastic waste has become a pressing global challenge, significantly exacerbated by the increasing reliance on single-use plastics in households. Inadequate waste management systems, combined with low public awareness and insufficient recycling infrastructure, have led to environmental degradation, public health risks, and economic losses (Debrah et al., 2021; Roche Cerasi et al., 2021; Shershneva, 2021). Improper disposal of plastic waste contributes to land, water, and air pollution, disrupting ecosystems and threatening biodiversity. Moreover, the economic potential of plastics as a recyclable resource remains largely untapped, leading to unsustainability in the long term (Seay & Ternes, 2022). Addressing the issue of household plastic waste requires a holistic approach that integrates environmental conservation with socio-economic development.

In Africa, Eldoret town has become Kenya's fifth city after Nairobi, Kisumu, Mombasa and Nakuru (KSDPA, 2024) after it was conferred city status on 15th August 2024. This means that Eldoret City like many other cities is experiencing rapid urbanization and population growth, leading to an increase in the generation of household plastic waste. Despite the potential for recycling and reuse, a significant portion of this waste ends up in open dumpsites, drains, and other public spaces, contributing to environmental degradation and public health risks (Omokaro et al., 2024; Shelemo, 2023). Inefficient waste collection systems, limited recycling infrastructure, and a lack of public awareness aggravate the problem, resulting in the accumulation of non-biodegradable plastics that pollute the environment.

Additionally, the economic potential of plastic waste remains largely untapped in Eldoret City. Opportunities for income generation through recycling, reusing, and upcycling initiatives are underutilized due to insufficient investment, weak policy enforcement, and limited community participation (Orori, 2018). This has left many informal waste collectors and recyclers unable to benefit from structured waste management systems that could improve their livelihoods. Without comprehensive and sustainable strategies, the current plastic waste management practices in Eldoret threaten the city's environmental integrity, economic development, and social well-being. Addressing these challenges requires an integrated approach that combines environmental conservation with socio-economic sustainability to ensure that plastic waste is managed in a way that benefits the community and supports sustainable urban development.

Objectives

The general objective is to investigate the effect of household plastic waste management on Socio-economic and environmental sustainability in Eldoret City. Specifically, the study will assess the current state of household plastic waste management, identify challenges in household plastic waste management in Eldoret City, Evaluate the socio-economic opportunities in plastic waste management and develop strategies for sustainable plastic waste management in Eldoret City.

Theoretical Review

The theoretical foundation of household plastic waste management and socio-economic sustainability draws on several interconnected theories which, provide insights into waste management practices, community participation, and sustainable development, forming the basis for analyzing challenges and designing effective strategies.

The Circular Economy Theory

The circular economy is a result of contributions from various thinkers, researchers and organizations overtime (Ellen MacArthur Foundation, 2013; Maitre-Ekern, 1966; Mohajan & Kumar, 2022).The circular economy emphasizes minimizing waste and maximizing resource efficiency by promoting recycling, reuse, reduction and upcycling. It shifts away from the traditional linear economy (take-make-dispose) to a closed-loop system where materials are reused to create value continuously. This theory underscores the importance of integrating plastic waste into a circular model, reducing environmental impact while generating economic opportunities. In the context of Eldoret City, the circular economy framework can guide efforts to turn household plastic waste into a resource for employment creation and economic growth.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB), developed by Icek Ajzen (1991), explains human behavior based on three primary factors: attitudes, subjective norms, and perceived behavioral control. These factors influence an individual's intention, which ultimately determines their behavior. Applying TPB to household plastic waste management offers a theoretical framework for understanding and promoting sustainable waste practices, thereby contributing to socio-economic sustainability. Theory of Planned Behavior, provide insights into how individual attitudes, social norms, and perceived control influence waste disposal habits (Parker et al., 1995). This theory is essential for designing educational campaigns and interventions to encourage households in Eldoret City to adopt sustainable practices like waste segregation and recycling.

Sustainable Development Theory

The concept of sustainable development, as articulated by the Brundtland Report (1987), emphasizes meeting present needs without compromising future generations' ability to meet their own. This theory integrates environmental, social, and economic dimensions, advocating for

balanced development (Hajian & Kashani, 2021) leading to Sustainable Development Goals (SDGs). For Eldoret City, sustainable development theory provides a foundation for linking plastic waste management with socio-economic benefits, such as job creation, poverty reduction, and environmental conservation.

Social Capital Theory

Social capital theory emphasizes the value of social networks, trust, and collaboration in achieving collective goals (Nan Lin, Karen S. Cook, 2001). Effective plastic waste management in Eldoret City requires active community participation and cooperation among households, local governments, and private stakeholders. Building social capital can strengthen waste management systems by fostering trust, encouraging behavioral change, and enhancing Public-Private Partnerships (PPPs).

The Tragedy of the Commons

Proposed by Garrett Hardin, this theory highlights the overexploitation and mismanagement of shared resources due to individual self-interest (Hardin, 1968). Plastic waste pollution in public spaces and waterways in Eldoret City can be viewed through this lens, where the absence of effective regulations and community ownership leads to environmental degradation. Addressing this issue requires policies and community-driven initiatives to foster collective responsibility and sustainable waste management practices.

Systems Theory

Systems theory views waste management as an interconnected system comprising multiple stakeholders, processes, and feedback loops (Cart et al., 1972). It highlights the need for a holistic approach, considering components such as waste generation, collection, transportation, recycling, and disposal. Applying systems theory to Eldoret City allows for identifying bottlenecks and designing integrated solutions that address technical, social, and economic aspects of plastic waste management.

Conceptual Review

This conceptual review provides a framework for understanding the interplay between household plastic waste management and socio-economic sustainability. It focuses on key dimensions, their interrelationships, and their relevance to the study in Eldoret City.

Household Plastic Waste Management

Household plastic waste management refers to the processes and practices involved in handling plastic waste generated by households, including collection, segregation, recycling, reuse, and disposal (Yintii et al., 2014). Effective management aims to minimize environmental harm while maximizing the potential for resource recovery. Key dimensions in household plastic waste

management include waste generation, waste segregation, upcycling, recycling, reuse and disposal (Chen et al., 2021; Chow et al., 2017; Yintii et al., 2014).

Waste generation is the understanding of the types and quantities of plastic waste produced by households in Eldoret City. Waste Segregation is sorting waste at the source to facilitate recycling and reduce contamination. Recycling and reuse entails converting waste plastics into new products or reusing them to extend their lifecycle. Upcycling entails the reuse of discarded objects or materials in such a way as to create a product of higher quality or value than the original. Disposal includes methods such as landfilling, incineration, or improper dumping, emphasizing on reducing environmentally harmful practices.

Socio-economic Sustainability and Waste Management

Socio-economic sustainability involves strategies and practices that balance social well-being and economic development while preserving environmental resources (Rublev et al., 2021) . Socio-economic sustainability in waste management revolves around economic opportunities, social equity and environmental stewardship (Fehr et al., 2020). Economic Opportunities posed by waste management socio-economic sustainability leads to the creation of employment and fostering innovation in waste management and recycling. Social equity (Barford & Ahmad, 2021) ensures that there is community participation, fair access to resources, and support for informal waste workers. Environmental stewardship focuses on reducing pollution, conserving resources, and promoting a cleaner urban environment.

Integrated Waste Management Systems

An integrated waste management system incorporates diverse methods and stakeholders to manage waste sustainably. It involves a combination of formal waste collectors, informal waste collectors and public-private partnerships. On one hand, formal waste collection services are structured systems for collecting and processing waste (Barford & Ahmad, 2021). On the other hand, informal waste collectors are Individuals and groups operating outside formal systems, often critical for recycling efforts. Public-Private Partnerships (PPPs) are collaborative initiatives between government bodies and private entities to enhance waste management infrastructure and services (Spoann et al., 2019).

Circular Economy practices and Household Plastic Management,

The circular economy focuses on keeping materials in use for as long as possible, minimizing waste, and regenerating natural systems (Babaremu et al., 2022). Applying this concept to plastic waste includes designing for recyclability, resource recovery and zero-waste goals (Awogbemi et al., 2022; Hamid, Saima; Skinder, Bhat Mohd; Bhat, 2020). Designing for recyclability encourages the production of easily recyclable plastics. Resource recovery extracts value from waste plastics through recycling. Zero-Waste Goals reduces waste generation and maximizes material recovery.

Community Awareness and Participation in Waste Management

Community involvement is vital for effective plastic waste management. Community households can be engaged in household plastic waste management through awareness campaigns, behavior change and stakeholder engagement (Brotosusilo et al., 2020). Awareness campaigns can educate members of the household about the environmental and economic benefits of proper waste management, particularly plastics. Behavioral Change can be achieved through encouraging sustainable practices, such as waste segregation and participation in recycling programs. Stakeholder engagement involves local governments, businesses, and residents in decision-making processes.

Challenges in Household Plastic Waste Management

Several barriers hinder effective household plastic waste management in Eldoret City (Orori, 2018; Seay & Ternes, 2022). Firstly, there is infrastructure Gaps. This implies that there is insufficient recycling facilities and waste collection services. Secondly, there is weak enforcement of waste management laws and regulations. Thirdly there is limited funding for waste management programs posing household plastic waste management economic constraints. Last but not least is the low awareness and participation among households on plastic waste management.

LITERATURE REVIEW

Household plastic waste management has become a significant environmental and socio-economic challenge globally (Shershneva, 2021), and Eldoret City in Kenya is no exception. The growing population, urbanization, and increased consumption of plastic products contribute to the rising volume of plastic waste in Eldoret. This review examines the existing literature and empirical studies on plastic waste management practices in urban households, focusing on Eldoret City, while exploring strategies for enhancing socio-economic sustainability in the region.

Household Plastic Waste Generation and Management in the City of Eldoret

Eldoret, a rapidly growing City in Kenya, is characterized by an increasing population and urbanization, leading to heightened plastic waste generation. According to a study by (Cheruiyot & Sitienei, 2020), the primary sources of recyclable household waste in Eldoret City include plastic, waste paper, glass, rubber, cardboards, sludge and scrap metal. The rapid growth of retail and commercial establishments has amplified the production and disposal of plastic products. The management of this waste is primarily handled by the local government authorities (Uasin Gishu County government), although community-based initiatives also play a significant role.

Empirical research has indicated that plastic waste management systems in Eldoret City are faced with several challenges. These include limited infrastructure for waste collection, lack of public awareness about recycling, and inadequate enforcement of environmental regulations (Omollo, 2019). Omollo highlights that most households in Eldoret City dispose of plastic waste improperly,

either through open dumping or burning, which leads to environmental pollution and health risks. The lack of formal waste segregation, recycling systems, and the low participation of households in waste management efforts hinder the sustainable handling of plastic waste.

Socio-economic and Environmental Impact of Household Plastic Waste in Eldoret

The mismanagement of plastic waste in Eldoret City has significant socio-economic implications. First, the environmental degradation caused by plastic pollution has adverse effects on agriculture, tourism, and public health, which are key sectors in the city's economy. (Ngeno et al., 2023) found that plastic pollution negatively impacts agricultural productivity by contaminating soil and waterways, leading to reduced crop yields and economic losses for farmers. Additional plastic waste can cause complex hazardous derivatives and byproducts.

Furthermore, improper plastic waste management strains the local government's budget for waste collection and disposal (Cheruiyot & Sitienei, 2020; Omollo, 2019). The need for more robust infrastructure, including recycling facilities and waste management education, has increased. However, the cost of such initiatives can overwhelm local authorities, limiting the potential for sustainable development. In addition, poor waste management often contributes to the spread of diseases, leading to increased healthcare costs (Yang et al., 2018).

Strategies for Socio-economic Sustainability

To ensure the socio-economic sustainability of Eldoret City in the face of plastic waste challenges, several strategies need to be employed. First is promoting waste segregation at the household level. Studies like (Trushna et al., 2024) suggest that waste segregation at the household level is critical for the efficient management of plastic waste. Educating residents on the importance of separating recyclable plastics from other waste could improve recycling rates and reduce landfill burden. Local governments and NGOs can collaborate to organize training programs, workshops, and awareness campaigns to promote waste segregation.

Second is investing in recycling infrastructure. The development of formal recycling infrastructure is essential for the effective management of household plastic waste. According to (Lubongo & Alexandridis, 2022; Onn et al., 2024), investments in recycling technologies, such as plastic shredders and sorting machines, could create a circular economy, where plastic waste is recycled into new products, reducing the need for virgin materials and contributing to job creation. Additionally, establishing recycling centers across Eldoret would reduce the need for waste transportation, cutting costs and environmental impacts.

Third is the utilization Public-Private Partnerships (PPPs). Collaborations between the government and private companies could improve plastic waste management. (Ishawu et al., 2020) notes that partnerships with recycling companies, waste collectors, and businesses could enhance the financial viability of waste management programs and generate employment opportunities. These

partnerships could focus on creating value-added products from recycled plastic, such as construction materials and household goods.

Fourth is the policy implementation and enforcement. The enforcement of plastic waste management policies is critical for ensuring long-term sustainability. The Kenyan government must strengthen the enforcement of regulations that limit plastic use, such as the ban on single-use plastics (Amugsi et al., 2022; Pokhrel & Opondo, 2024). Moreover, penalties for illegal dumping should be strictly imposed to discourage improper disposal. Additionally, the government can incentivize recycling by providing subsidies or tax exemptions to businesses that use recycled plastic.

Fifth is Community-Based waste management initiatives. Several studies, including (Salvia et al., 2021; Sinthumule & Mkumbuzi, 2019), suggest that community-based initiatives, such as the establishment of waste collection cooperatives, can be an effective way of managing plastic waste at the grassroots level. These initiatives would empower local residents to actively participate in waste reduction efforts, reduce littering, and promote sustainable consumption patterns.

Community Awareness and Participation in Plastic Waste Management

Plastic waste management has emerged as a critical issue for communities, with its impact being felt in urban areas like Eldoret City, Kenya. Rapid urbanization, increased consumption of plastic products, and inadequate waste management infrastructure have led to environmental pollution and socio-economic challenges (Chow et al., 2017). Addressing these concerns requires a combination of community awareness and active participation in household plastic waste management strategies to ensure environmental sustainability and economic benefits (Brotosusilo et al., 2020; Chow et al., 2017).

The level of environmental awareness within communities remains insufficient, indicating a pressing need to enhance this awareness in order to promote behaviors that favor the use of environmentally friendly plastics (Herdiansyah et al., 2022). With this in mind, adopting a responsible approach to plastic usage begins with reducing overall consumption and fostering a commitment to sorting and recycling materials (Orori, 2018).

Effective plastic waste management begins with creating effective societal marketing awareness campaigns among residents of Eldoret City (Cheruiyot & Sitienei, 2021). That is to say, the community must understand the environmental and health hazards associated with improper plastic disposal. By all means, social marketing and community-based organizations' awareness campaigns should focus on, health impacts, environmental consequences, waste segregation practices, and informing the community about the existing government policies and regulations on waste management (Dagarp et al., 2023; Muposhi et al., 2023).

METHODOLOGY

This study adopts a desktop research (secondary research) approach to analyze household plastic waste management strategies for socio-economic and environmental sustainability in Eldoret City, Kenya. The study involved collecting, reviewing, and synthesizing existing literature, relevant to the research topic. The existing literature was extracted from Google Scholar with the aid of Boolean operands.

FINDINGS

Kenya just like the rest of the world is being inundated by plastics where 400 million tons of plastics is produced annually half of which is designed to be used once (NEMA, 2023). Modern cities dwellers including Eldoret consume a great deal of plastics due to their accessibility, low cost and presence of neighbors who haven't embraced the ban of single use plastics. This makes it possible for their infiltration and getting their way to Kenya Markets through unscrupulous traders.

Additionally, the burgeoning expansion of retail and commercial sectors has significantly increased the generation, use and disposal of plastic products. Subsequently, the investigation revealed that the level of environmental awareness within local communities in Eldoret City is notably inadequate, underscoring an urgent necessity to bolster this awareness to encourage practices that support the utilization of environmentally sustainable plastics. Significant evidence from literature shows that solid waste management is at the core of urban environmental problems.

This study unearthed several obstacles that impede effective management of household plastic waste in Eldoret City. Infrastructural deficiencies, which manifest as a lack of adequate collection, transfer, resource recovery, recycling, and treatment facilities were manifest (Cheruiyot & Sitienei, 2021). Additionally, there is a notable weakness in the enforcement of waste management laws and regulations, compounded by limited financial resources allocated to waste management initiatives, which further restricts the operations related to household plastic waste management.

Moreover, the study pointed out the low levels of awareness and participation among households regarding plastic waste management practices. This study reveals significant socio-economic repercussions associated with plastic waste in Eldoret city. Specifically, plastic pollution adversely affects agricultural productivity by contaminating both soil and water sources, which in turn diminishes crop yields and results in financial losses to farmers. Furthermore, inadequate management of plastic waste places considerable pressure on the local government's financial resources allocated for waste collection and disposal. In addition, rudimentary and ineffective waste management practices often facilitate the proliferation of diseases, thereby escalating healthcare expenditures.

Sound waste management of materials like plastics includes four elements: waste reduction, segregation, recycling, and upcycling. The best solution is not to generate this waste in the first place. When this is not possible, every effort should be made to minimize generation, and generated wastes should be handled carefully to reduce risks. Producers of such waste should segregate different types of materials to make recycling and upcycling easier. This study identifies several pivotal strategies aimed at enhancing plastic waste management and promoting socio-economic and environmental sustainability.

The strategies encompass implementation of waste segregation at the household level, where educating residents on the significance of separating recyclable plastics from general waste could lead to improved recycling rates and alleviate the burden on the city ecosystem. Moreover, investing in advanced recycling technologies, such as plastic shredders and sorting machines, could foster upcycling by transforming plastic waste into new better plastic products, thereby reducing reliance on virgin materials and creating job opportunities. Collaborations with recycling firms, waste collectors, and local businesses could further bolster the financial sustainability of waste management initiatives and generate employment.

Indeed, this study finds that it is crucial to reinforce the enforcement of regulations aimed at curbing plastic usage, including the prohibition of single-use plastics and imposing penalties for illegal dumping, to deter improper disposal practices. Community-driven initiatives, such as the formation of waste collection cooperatives, may also serve as an effective approach to managing plastic waste at the grassroots level of the City of Eldoret.

CONCLUSIONS

In conclusion, household plastic waste management in Eldoret City presents significant challenges but also offers opportunities for socio-economic sustainability. The rapid urbanization and increased consumption of plastic products have resulted in a substantial rise in plastic waste, which is not being managed effectively due to inadequate infrastructure, limited public awareness, and weak enforcement of waste management regulations. Most households rely on rudimentary informal and ineffective waste disposal methods such as open dumping and burning, which have detrimental effects on the environment, public health, and local economy.

The socio-economic implications of poor plastic waste management are far-reaching, affecting key sectors such as agriculture, public health, and local government finances. By adopting effective waste management strategies, Eldoret can reduce the burden of plastic pollution, improve public health outcomes, and create economic opportunities through recycling and the development of green industries. These efforts will not only contribute to environmental sustainability but will also promote economic growth, job creation, and improved quality of life for residents.

However, there is a growing recognition of the importance of sustainable plastic waste management. This study has shown that while community awareness and participation in plastic recycling are still limited, there is considerable potential for improvement. Strategies such as promoting waste segregation at the household level, investing in recycling infrastructure, strengthening public-private partnerships, and enforcing regulations can significantly improve the management of plastic waste in Eldoret.

Moreover, enhancing public education on the environmental and health impacts of improper disposal can foster a culture of responsibility and encourage sustainable consumption patterns among residents. Ultimately, addressing the plastic waste challenge in Eldoret requires a collaborative approach, involving local authorities, businesses, community members, and the private sector. With the right policies, infrastructure, and awareness-raising efforts, Eldoret can transition towards a more sustainable and resilient city, paving the way for a cleaner, healthier, and economically prosperous future.

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